SECTION 6

6.11 CONTROL OF BACKFLOW AND CROSS CONNECTION:

A. Cross Connection Control:

1. Denver Water is responsible for the protection of its public water system from contamination or pollution due to the backflow of contaminants or pollutants through the water service connection. The purpose of this program is to:

   a. Protect the public water supply of Denver Water from the possibility of contamination or pollution by containing within the customer's internal distribution system(s) or the customer's private water system(s) such contaminants or pollutants which could backflow into Denver Water's water system; and

   b. Eliminate or control existing cross connections, actual or potential, between the customer's in-plant potable water system(s)(and non-potable water system(s), plumbing fixtures and industrial piping systems; and

   c. Provide for the maintenance of the Continuing Program of Cross Connection Control which will systematically and effectively prevent the contamination or pollution of potable water supplied by Denver Water.

B. Requirements for Backflow Prevention:

1. The water system will be considered as made up of two parts, Denver Water's system and the customer's.

   a. Denver Water's system consists of the source facilities and the distribution system, and includes all those facilities of the water system under complete control of Denver Water up to the point where the customer's system begins.

   b. The customer's system includes those parts of the facilities beyond the termination of Denver Water distribution system and are no longer under Denver Water's control.

2. An approved backflow prevention device will also be installed on each service line within a customer's water system, immediately following the meter, and in all cases, before the first branch line leading off the service line wherever the following conditions exist:

   a. In the case of a premise with an auxiliary water supply which is not or may not be of safe bacteriological or chemical quality and which is not acceptable as an additional source by Denver Water, Denver Water's water system will be protected against backflow from the premises by installing an approved backflow prevention

device in the service line appropriate to the degree of hazard found within the customer's premises.

b. In the case of premises on which any industrial fluids or any other objectionable substance is handled in such a fashion as to create an actual or potential hazard to Denver Water's water system, Denver Water's system will be protected against backflow from the premises by installing an approved backflow prevention device in the service line appropriate to the degree of hazard found within the consumer's premises. This will include the handling of process waters originating from Denver Water's system, which have been subject to deterioration in quality.

c. In the case of premises having internal cross connections that cannot be permanently corrected and controlled, or having intricate plumbing and piping arrangements or where entry to all portions of the premises is not readily accessible for inspection purposes, making it impractical or impossible to ascertain whether or not dangerous cross connections exist, Denver Water's water system will be protected against backflow from the premises by installing a backflow prevention device in the service line.

d. In the case of premises where there is a fire protection system, an approved backflow prevention assembly must be installed on all water service connections. These would include such systems as residential, commercial industrial or institutional facilities serving any combination of fire hydrants, potable water and fire protection systems. The type of device required will depend upon the degree of hazard as determined by the Cross Connection Control Manual of the Colorado Department of Public Health and Environment.

3. The type of protective device required will depend upon the degree of hazard, as follows:

a. In the case of any premises where there is an auxiliary water supply, Denver Water's water system must be protected by an approved air-gap separation or an approved reduced pressure principle backflow prevention assembly.

b. In the case of any premises where there is water or a substance that would be objectionable, but not hazardous to health, Denver Water's water system must be protected by an approved double check valve assembly or an approved reduced pressure backflow prevention assembly.

c. In the case of any premises where there is any material dangerous to health, which is handled in such a fashion as to create an actual or potential hazard to Denver Water's water system, Denver Water's water system must be protected by an

approved air-gap separation or an approved reduced pressure principle backflow prevention assembly. Examples of premises where these conditions exist include, but are not limited to, sewage treatment plants, sewage pumping stations, chemical manufacturing plants, hospitals, mortuaries, and metal plating facilities.

d. In the case of any premises where there are "uncontrolled" connections, either actual or potential, Denver Water's water system must be protected by an approved air-gap separation or an approved reduced pressure principle backflow prevention assembly at the service connection.

e. In the case of any premises where, because of security requirements or prohibitions or restrictions, it is impossible or impractical to make a complete in-plant cross connection survey, Denver Water's water system must be protected against backflow from the premises by an approved air-gap separation or an approved reduced pressure principle backflow prevention assembly on each service line to the premises.

4. Any backflow prevention device required will be a model and size designated by Denver Water and approved by the Colorado Department of Public Health and Environment. The term approved backflow prevention assembly will mean a device that has been manufactured in full conformance with AWWA C511-97 and, have met completely the laboratory and field performance specifications of the Foundation for Cross Connection Control and Hydraulic Research (FCCC&HR) of the University of Southern California established by: Specifications of Backflow Prevention 69-2, or the most current issue. AWWA and FCCC&HR standards and specifications are adopted by Denver Water. Final approval of backflow prevention devices will be evidenced by a Certificate of Approval issued by an approved testing laboratory certifying full compliance with said AWWA standards and FCCC&HR specifications. The following testing laboratory has been qualified by Denver Water and the Colorado Department of Public Health and Environment and accepted by Denver Water to test and certify backflow prevention devices:

   Foundation for Cross Connection Control and Hydraulic Research
   University of Southern California
   University Park
   Los Angeles, California 90007

5. It is the responsibility of the customer-user at any premises where backflow prevention devices are installed to have certified inspections and operational tests made at least once per year. In those instances where the hazard is high enough, it may require inspections at more frequent intervals. These inspections and tests will be at the expense of the customer-user and will be performed by a certified tester approved by Denver Water and/or the Colorado Department of Public Health and Environment. The customer-user will notify Denver Water in advance

when the tests are to be undertaken so that Denver Water's representative may witness the test if so desired. These devices will be repaired, overhauled or replaced at the expense of the customer-user whenever said devices are found to be defective. Records of such tests, repairs and overhaul will be kept by the customer-user, and a copy of such records will be furnished to Denver Water.

6. All presently installed backflow prevention devices which do not meet the requirements of this section but were approved devices for the purposes described herein at the time of installation and which have been properly maintained, will, except for the inspection and maintenance requirements under subsection G., be excluded from the requirements of these rules so long as Denver Water is assured that they will satisfactorily protect Denver Water's system. Whenever the existing device is moved from its present location or requires more than minimum maintenance or constitutes a hazard to health, the unit will be replaced by an approved backflow prevention device meeting the requirements of Denver Water.

7. Denver Water must review and approve the proposed backflow prevention device installation for all applications. Consultation with Denver Water Backflow Prevention Section may be required prior to plan submittal for special applications.

8. Backflow Prevention Assembly Installation Requirements:

    a. Approved backflow prevention assemblies shall not be modified in any way after the device leaves the manufacturer's factory.

    b. Backflow prevention devices shall be located in a room maintained at a minimum of 40°F and with electric illumination.

    c. Backflow prevention devices shall be installed where they are easily accessible for testing and maintenance.

    d. Acceptable facilities sized in accordance with the Uniform Plumbing Code, such as floor drains, must be provided in the room in which the backflow prevention device is located to accommodate testing and maintenance procedures.

9. This Engineering Standard incorporates herein by reference the Cross Connection Control Manual of the Colorado Department of Public Health and Environment and the Colorado Primary Drinking Water Regulations of the Colorado Department of Public Health and Environment including all amendments made now or hereafter. Whenever there is a conflict between this Engineering Standard and the Colorado Cross Connection Control Manual, the most stringent standard will apply.

C. Identification of Hazards:

1. A clear understanding of cross-connection hazards is essential to the selection of appropriate backflow prevention measures. The applicability of an air-gap separation or of certain types of mechanical backflow prevention assemblies for resolution of a particular backflow condition depends upon the type of backflow and the degree of hazard. The degree of hazard is the actual or potential threat of contamination or pollution resulting from a cross-connection. A contamination hazard is an actual or potential threat of contamination, of a biological, physical or toxic nature, to the Department's water system or the consumer's potable water system to a degree, which creates a hazard to public health. A potential hazard is an actual or potential threat of pollution to the Department's water system, or the consumer's potable water system, which does not create a hazard to public health.

2. Based on national experience, premises where existing or potential contamination hazards present an imminent and substantial endangerment to public health must always be separated from public potable water systems by cross-connection control by containment. Similarly, existing or potential contamination hazards that present an imminent and substantial endangerment to public health within a consumer's premise, must always be separated from the consumer's potable water system by cross-connection control by isolation.

3. Those premises for which separation from the Department's water system by containment is mandatory, are included in the list that follows:

    a. Unapproved auxiliary water supplies on premises, including private wells
    b. Premises where access is limited or restricted because of security concerns
    c. Hospitals, morgues, mortuaries, medical clinics, dental clinics, and autopsy facilities
    d. Laboratories
    e. Sewage treatment plants or facilities
    f. Food and beverage processing plants
    g. Chemical plants
    h. Metal plating industries
    i. Electrical and electronic component manufacturers
    j. Radioactive material processing plants
    k. Car and truck wash facilities
    l. Hydraulic testing facilities
    m. Packing houses, rendering plants, tanneries, and stock yard facilities
    n. Steam generating facilities
    o. Laundries, dry cleaners, laundromats
    p. Photographic film processing facilities
    q. Swimming pools and health spas
    r. Greenhouses
    s. Multi-storied buildings in excess of 30 feet above finished grade

t. Fire protection systems
u. Landscape irrigation systems
v. Taxidermy shops
w. Battery shops
x. Kennels, pet shops
y. Solar installations
z. Printing shops, screen printing shops
aa. Jewelry manufacturers
bb. Radiator shops
cc. Water service connections to commercial, industrial and institutional facilities

4. Table 1 has been developed to facilitate selection of the appropriate type backflow prevention for particular applications. Table 1 provides a correlation between cross-connections, degrees of hazard, and mandatory backflow prevention measures.

D. Special Applications:

1. Fire Protection Systems.

a. An approved backflow prevention assembly must be installed on any private fire protection system because of the following concerns:

1) The growth of offensive microorganisms, which can create taste and odor problems.

2) The leaching of heavy metals such as zinc, cadmium, iron, or lead into water which stands in pipelines for long periods of time.

3) The addition of corrosion inhibitors or antifreeze compounds to protect the piping systems.

4) Dry air systems containing compressed air.

5) A loss of pressure on the public water supply main or an increase in pressure on the consumer's system which would allow water from these systems to flow backward into Denver Water's system.

b. These hazards will vary from a non-health hazard to a health hazard. For this reason, it is required that all private fire systems must be protected from backflow. The protection will be commensurate with the degree of hazard. Listed below are those situations which determine the different fire system hazards, and the type of protection required for each:

1) Low or Moderate Hazard Fire Systems:

(a) Wet or dry with pumper connection.
(b) Wet system with an in-line booster pump.
(c) Any system with private hydrants
(d) Any looped system (an inter-tied system with more than one service connection).

2) High or Severe Hazard Fire Systems:

(a) Systems with pumper connections where corrosion inhibitors or other chemicals are added to the tanks of fire trucks.
(b) All foamite plant installation.
(c) Systems where an unapproved water supply can be connected to a fire system.
(d) Systems in which antifreeze is allowed.

c. Backflow Protection Required:

1. Low or Moderate Hazard Fire Systems require an approved Double Check Valve Assembly.

2. High or Severe Hazard Fire Systems require an approved Reduced Pressure Principle Backflow Assembly.

d. Installation of backflow prevention assemblies on systems involving fire pumps shall have a low suction pressure shutdown provided with a minimum operating pressure of 10 psi.

e. When retrofitting an existing fire protection system, prior to installing a backflow prevention device, the design and the installation must be reviewed and approved by a Colorado State Registered Professional Engineer experienced in fire protection. This review will involve an analysis of the existing fire protection system to ensure that the addition of the backflow prevention device will not adversely affect the fire protection system's performance.

f. When retrofitting an existing fire protection system, work shall be performed by a contractor registered with the State of Colorado, and where applicable, with the local fire protection authority, to work on fire protection systems.

g. In all cases, the water supplier is the final approval authority for installation of backflow prevention devices on fire protection systems.

2. Irrigation Systems

a. An approved backflow prevention assembly must be installed on all water service connections that are used exclusively for

landscape irrigation, and an approved backflow prevention assembly must be installed as an isolation device on residential, commercial, industrial, institutional, and public facilities that use the public water supply for lawn or landscape irrigation. Because landscape irrigation systems are subject to cross connections due to flooding, agricultural chemicals such as fertilizers, pesticides, fungicides, soil conditioners, and from submerged outlets, auxiliary water supplies, ponds, reservoirs, swimming pools, and other sources of stagnant, polluted or contaminated water, these systems are considered to be actual or potential high or severe hazard situations.

1) Backflow protection in the form of approved atmospheric and pressure vacuum breakers are approved for use in landscape irrigation system, with the following exceptions:

   (a) Locations subject to flooding
   (b) Systems which are subject to back pressure conditions
   (c) Systems winterized by injection of compressed air
   (d) Systems which inject fertilizers or other chemicals

2) With the exception of landscape irrigation systems, pressure vacuum breakers are not approved for cross connection control by containment. Atmospheric vacuum breakers are not approved for cross connection control by containment or whenever there is a control valve located downstream of the device.

3) Air gap separations or reduced pressure principle backflow assemblies are required for irrigation systems subject to the following conditions:

   (a) Locations subject to flooding
   (b) Systems subject to back pressure conditions
   (c) Systems winterized by injection of compressed air
   (d) Systems which inject fertilizers or other chemicals
   (e) Premises that have auxiliary water sources available for irrigation

4) Double check valves are not approved for landscape irrigation systems.

3. Solar Heating Systems

   a. An approved backflow prevention assembly must be installed on the water service line, as protection from cross connections, at any premise having a solar heating and/or cooling system that is connected to the consumer's water system, with the exception of a single-family residential premise, which must install an approved backflow prevention assembly as isolation protection

from cross connections. The hazards normally found in solar heating and/or cooling systems include cross connections between the consumer's water system and:

1) Reservoirs and storage tanks

2) Solar collector fluids which may contain:

   (a) Antifreeze compounds
   (b) Toxic corrosion inhibitors
   (c) Non-potable water
   (d) Single wall heat exchangers between consumers potable water and the collector fluids
   (e) Negative pressure zones created by circulation pumps

3) Some solar water heating systems rely on non-toxic antifreeze solutions and/or non-toxic corrosion inhibitors. However, Denver Water has no assurance that these systems will not be subsequently altered to utilize a toxic fluid; therefore, the required protection must be an approved reduced pressure principle backflow prevention assembly. It is to be used either as a containment device or as an isolation device.